Fig.1.

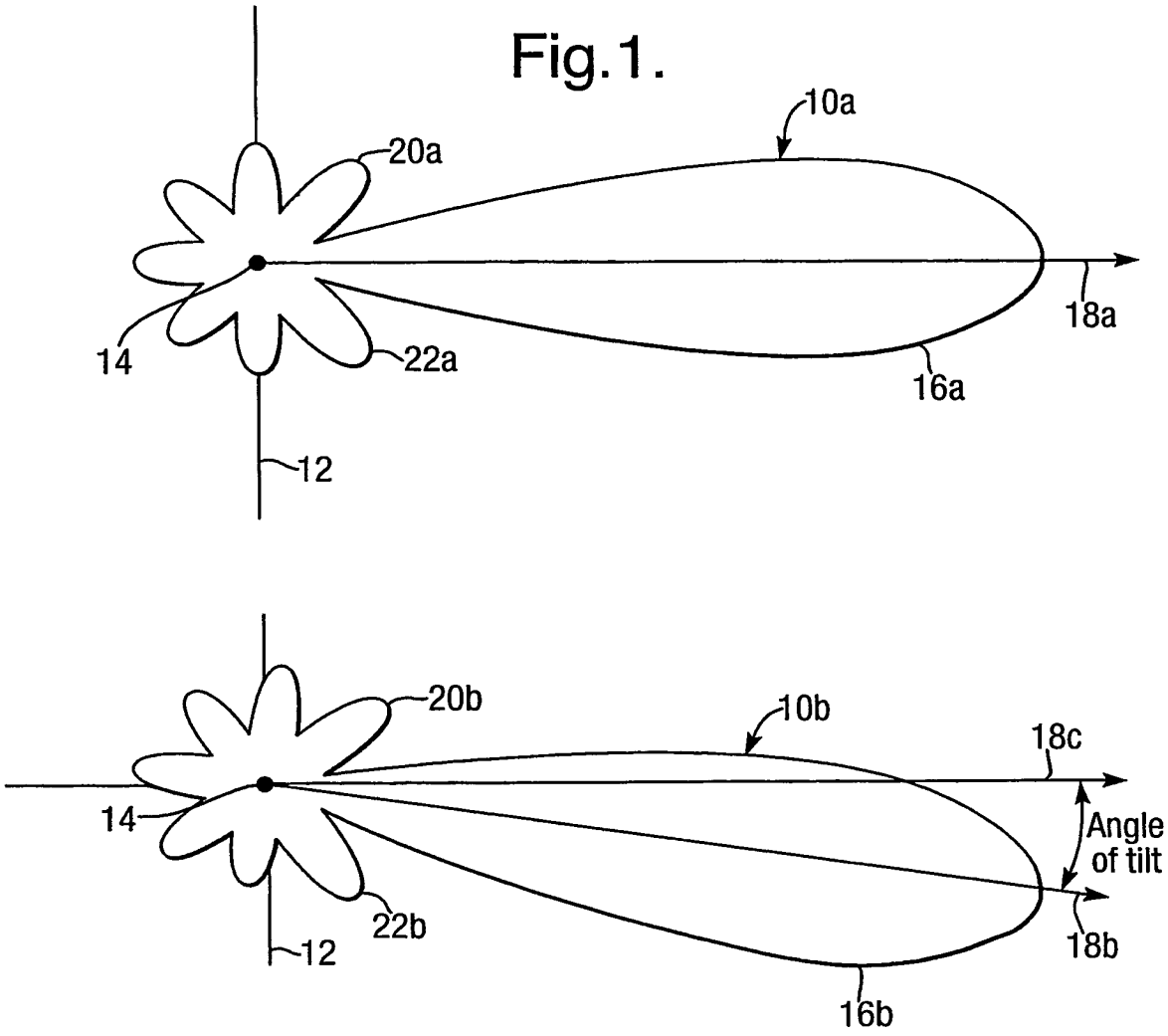
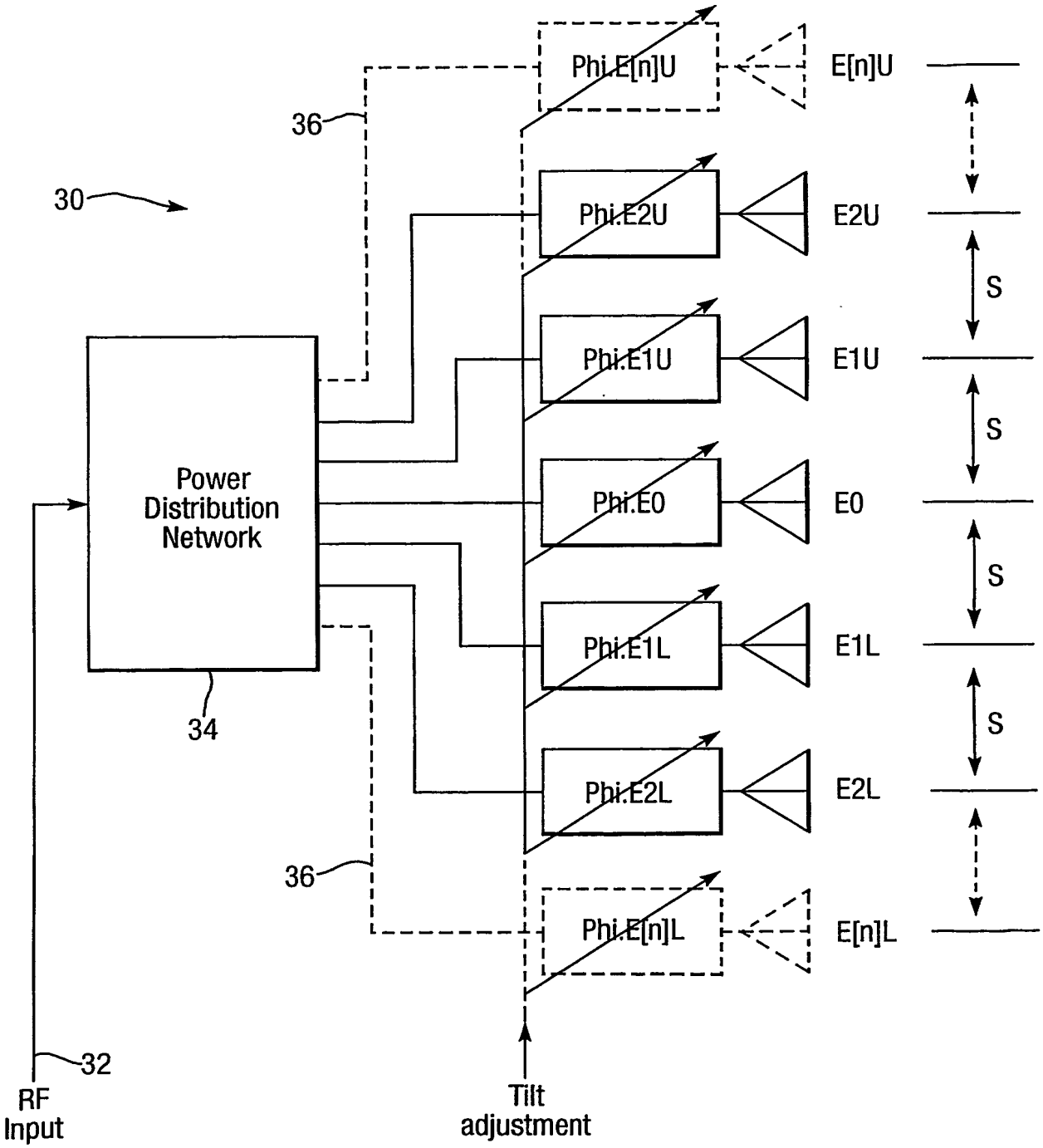

10a
20a
18a
14
22a
16a
12
20b
10b
18c
14
Angle
of tilt
22b
12
18b
16b

Fig.2.
(Prior art)



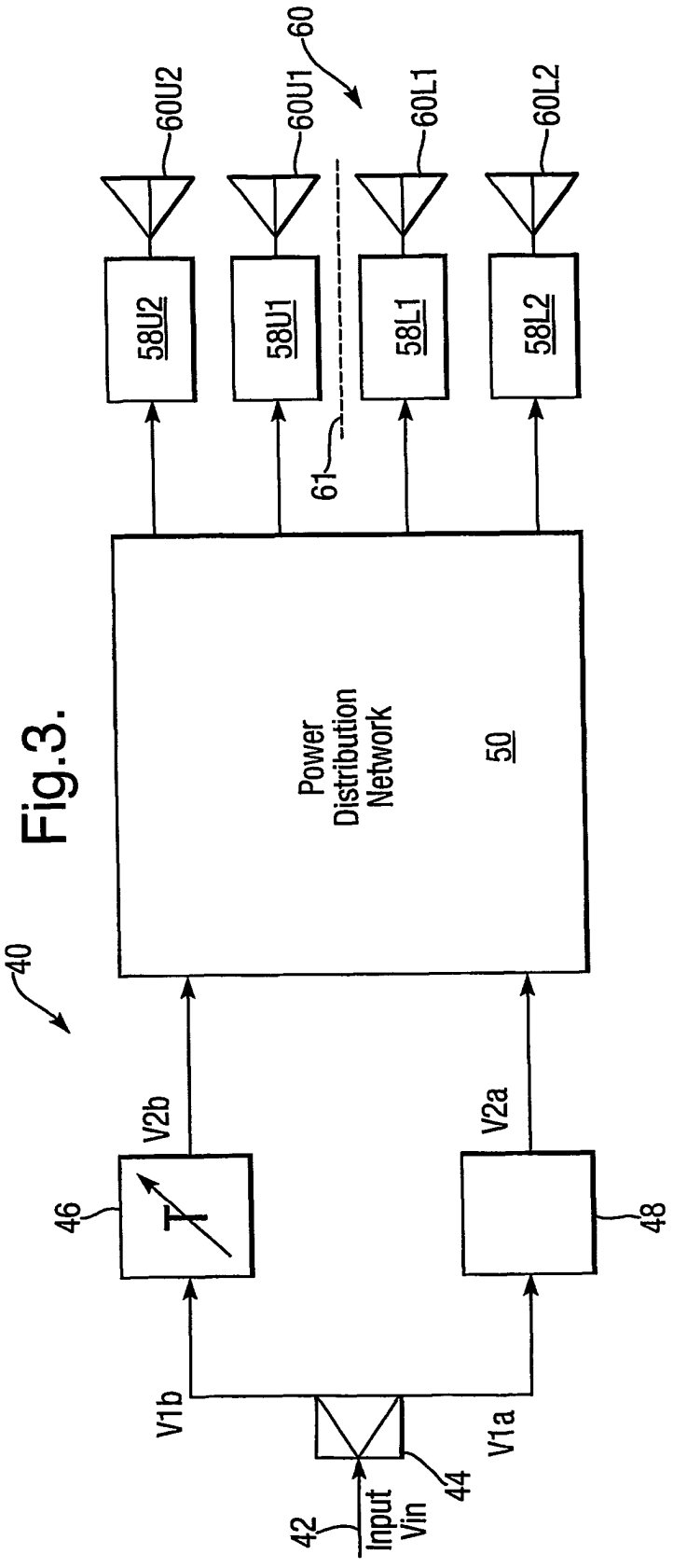

60
60U2
60U1
60L1
60L2
58U2
58U1
58L1
58L2
61
Power Distribution Network
50
40
V2b
V2a
46
48
V1b
V1a
44
42
Input Vin

Fig.3.

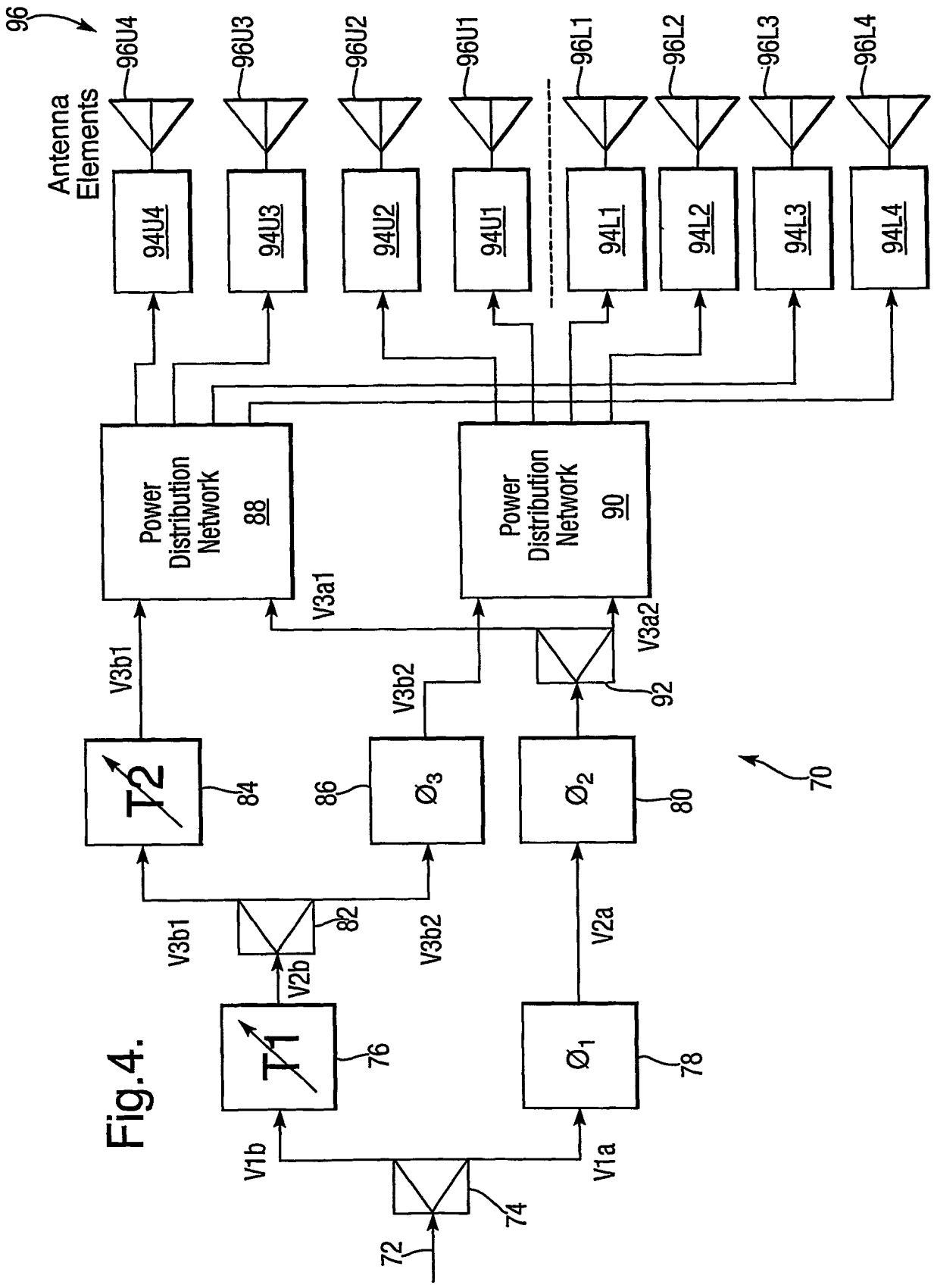
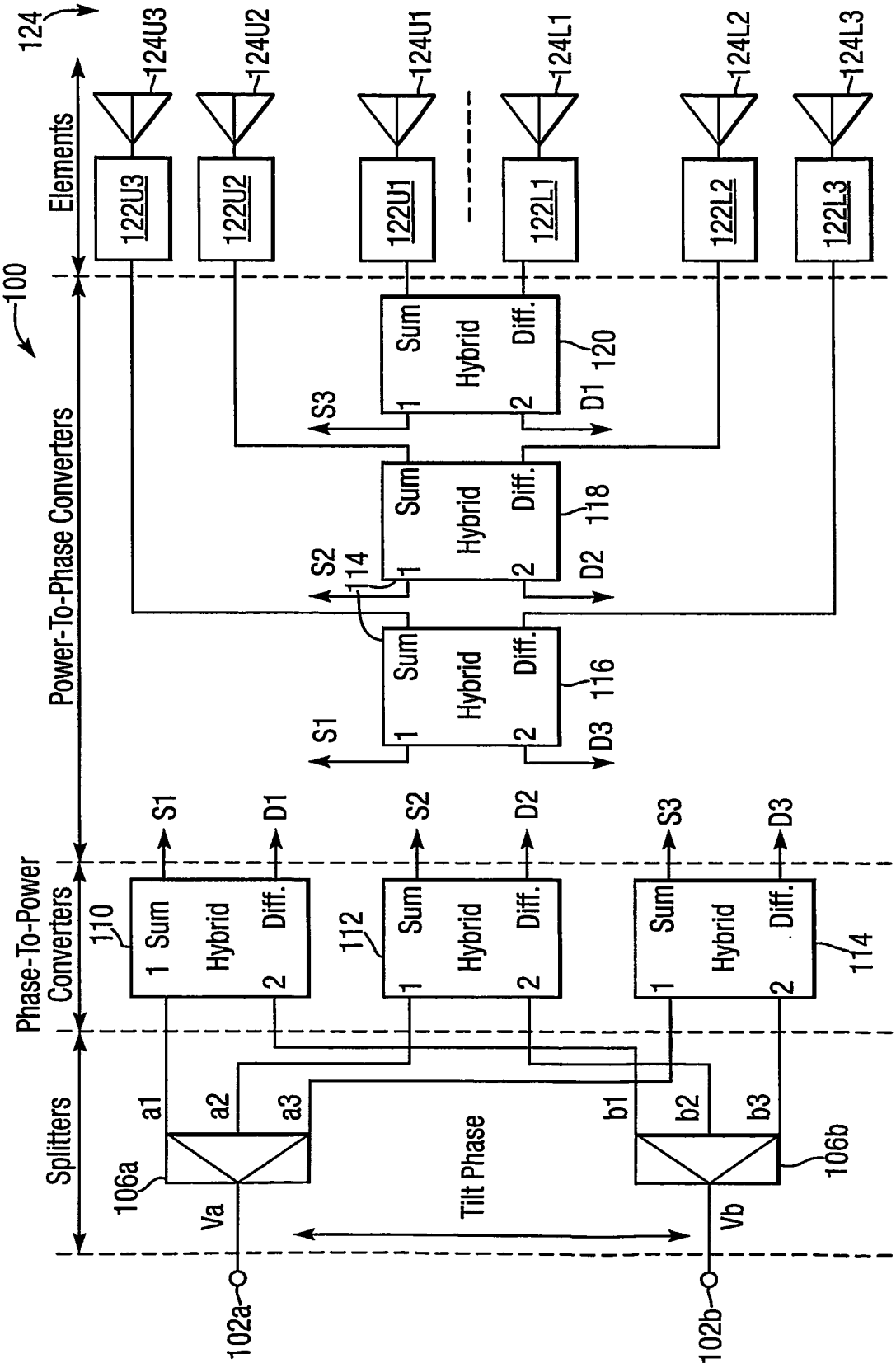

96
Antenna Elements
96U4
96U3
96U2
96U1
96L1
96L2
96L3
96L4
94U4
94U3
94U2
94U1
94L1
94L2
94L3
94L4
Power Distribution Network 88
Power Distribution Network 90
V3a1
V3a2
V3b1
V3b2
92
T2
84
86
Ø3
Ø2
80
70
V3b1
82
V3b2
V2a
V2b
T1
76
Ø1
78
V1b
V1a
74
72

Fig.4.

Fig.5.


124
Elements
122U3
122U2
122U1
122L1
122L2
122L3
124U3
124U2
124U1
124L1
124L2
124L3
100
Power-To-Phase Converters
Sum
Hybrid
Diff.
120
118
116
S1
S2
S3
D1
D2
D3
114
Phase-To-Power Converters
110
112
Splitters
a1
a2
a3
b1
b2
b3
106a
106b
Va
Vb
Tilt Phase
102a
102b

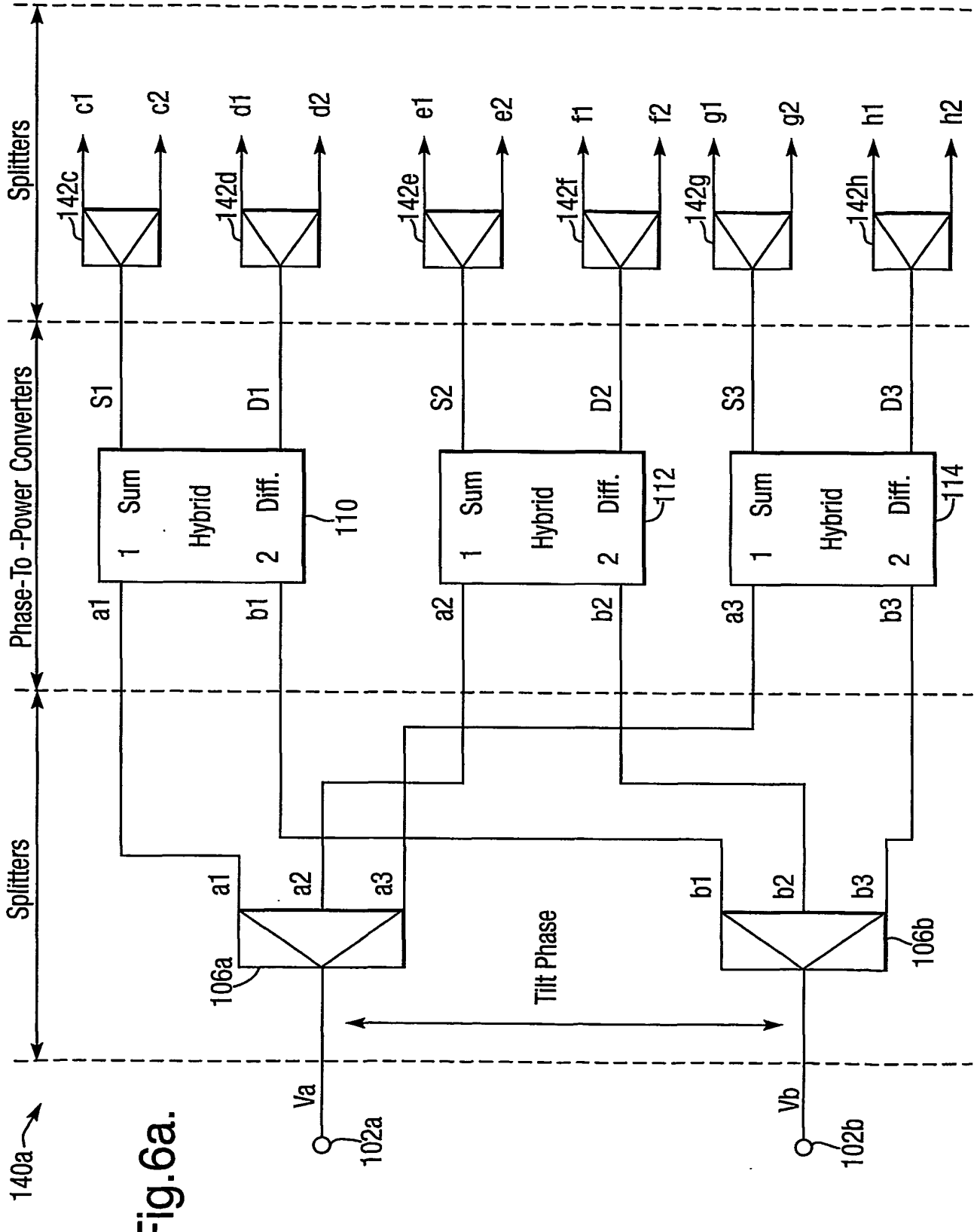

Splitters
Phase-To -Power Converters
Splitters
c1
c2
d1
d2
e1
e2
f1
f2
g1
g2
h1
h2
142c
142d
142e
142f
142g
142h
S1
D1
S2
D2
S3
D3
1 Sum Hybrid 2 Diff.
110
112
114
a1
b1
a2
b2
a3
b3
106a
106b
Tilt Phase
Va
Vb
102a
102b
140a

Fig.6a.

Fig.6b.

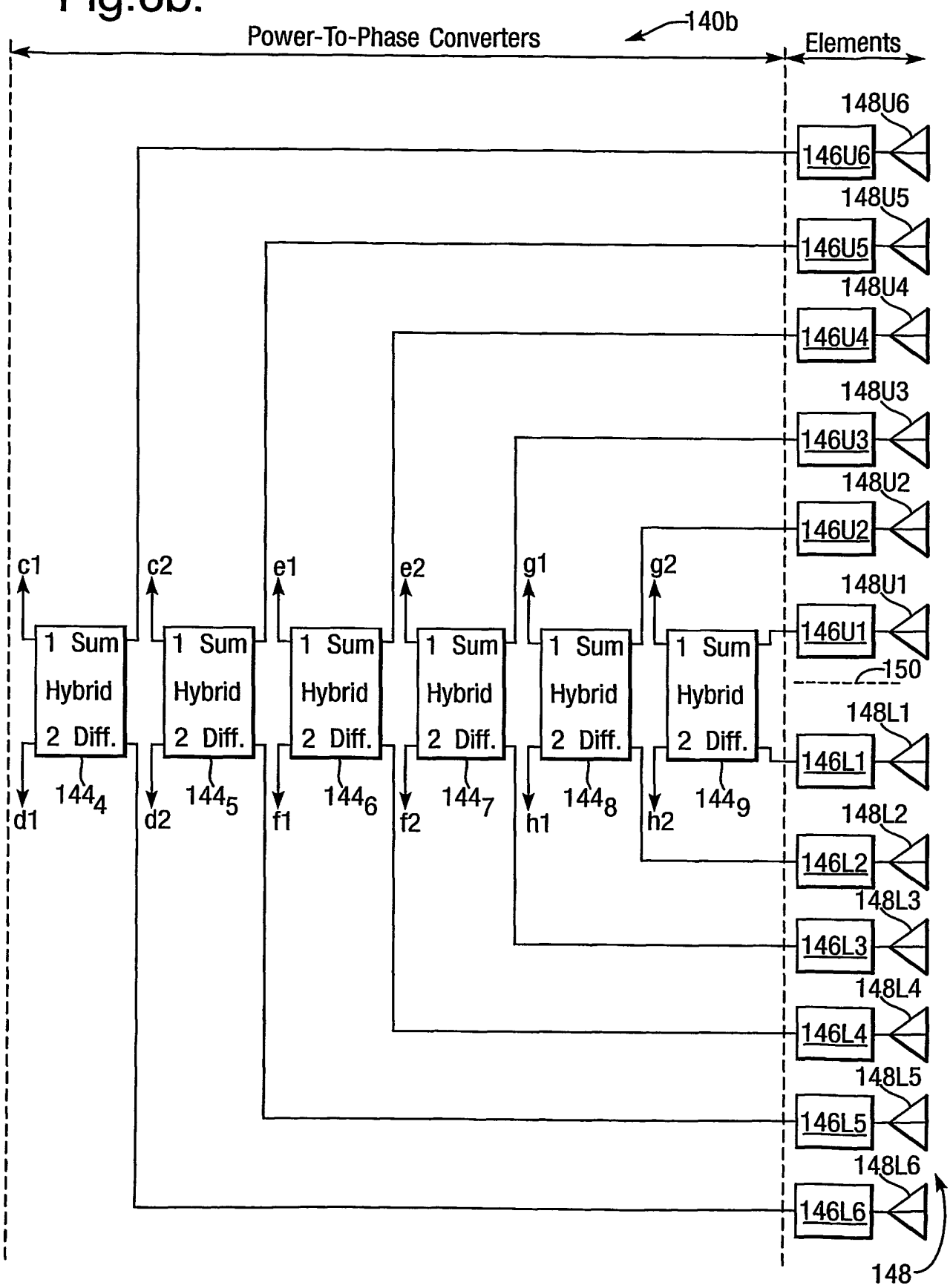

Power-To-Phase Converters
140b
Elements
148U6
146U6
148U5
146U5
148U4
146U4
148U3
146U3
148U2
146U2
148U1
146U1
150
148L1
146L1
148L2
146L2
148L3
146L3
148L4
146L4
148L5
146L5
148L6
146L6
148
c1
c2
e1
e2
g1
g2
1 Sum Hybrid 2 Diff.
144 4
144 5
144 6
144 7
144 8
144 9
d1
d2
f1
f2
h1
h2

Fig.7.

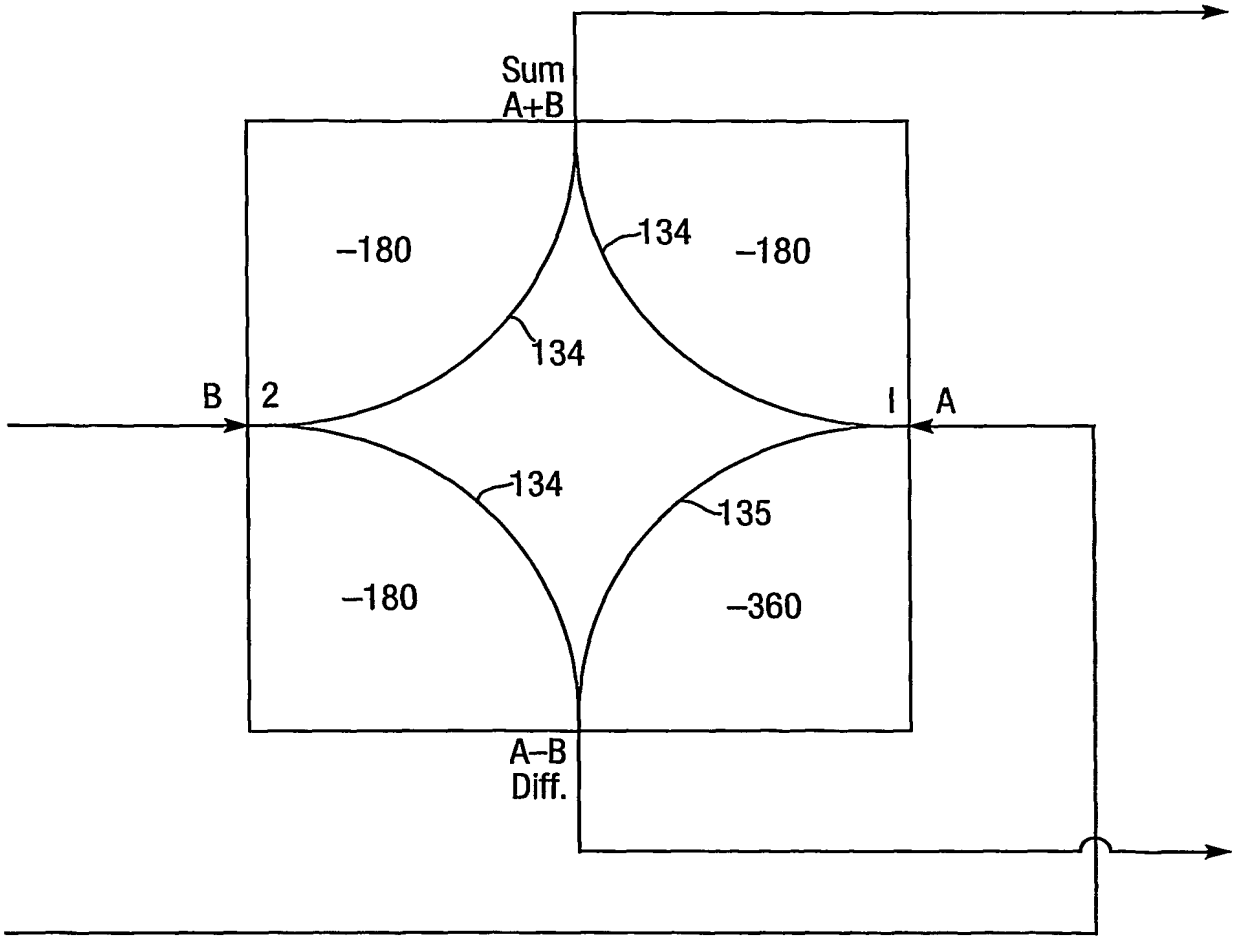


Fig.8a.

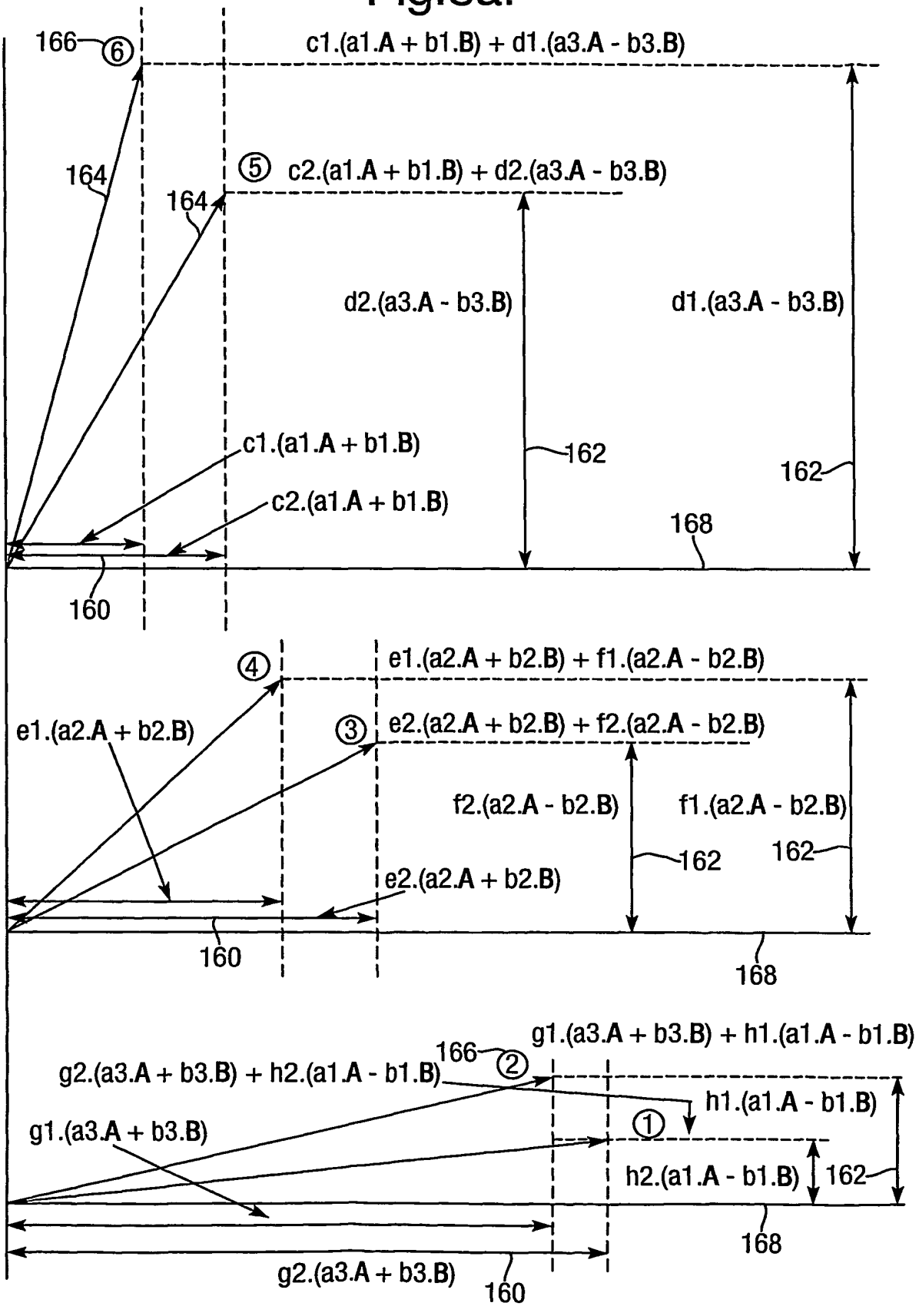

166
⑥
c1.(a1.A + b1.B) + d1.(a3.A - b3.B)
164
⑤ c2.(a1.A + b1.B) + d2.(a3.A - b3.B)
164
d2.(a3.A - b3.B)
d1.(a3.A - b3.B)
c1.(a1.A + b1.B)
162
162
c2.(a1.A + b1.B)
168
160
④
e1.(a2.A + b2.B) + f1.(a2.A - b2.B)
e1.(a2.A + b2.B)
③ e2.(a2.A + b2.B) + f2.(a2.A - b2.B)
f2.(a2.A - b2.B)
f1.(a2.A - b2.B)
162
162
e2.(a2.A + b2.B)
160
168
g1.(a3.A + b3.B) + h1.(a1.A - b1.B)
166
②
g2.(a3.A + b3.B) + h2.(a1.A - b1.B)
h1.(a1.A - b1.B)
①
g1.(a3.A + b3.B)
h2.(a1.A - b1.B)
162
168
g2.(a3.A + b3.B)
160

Fig.8b.

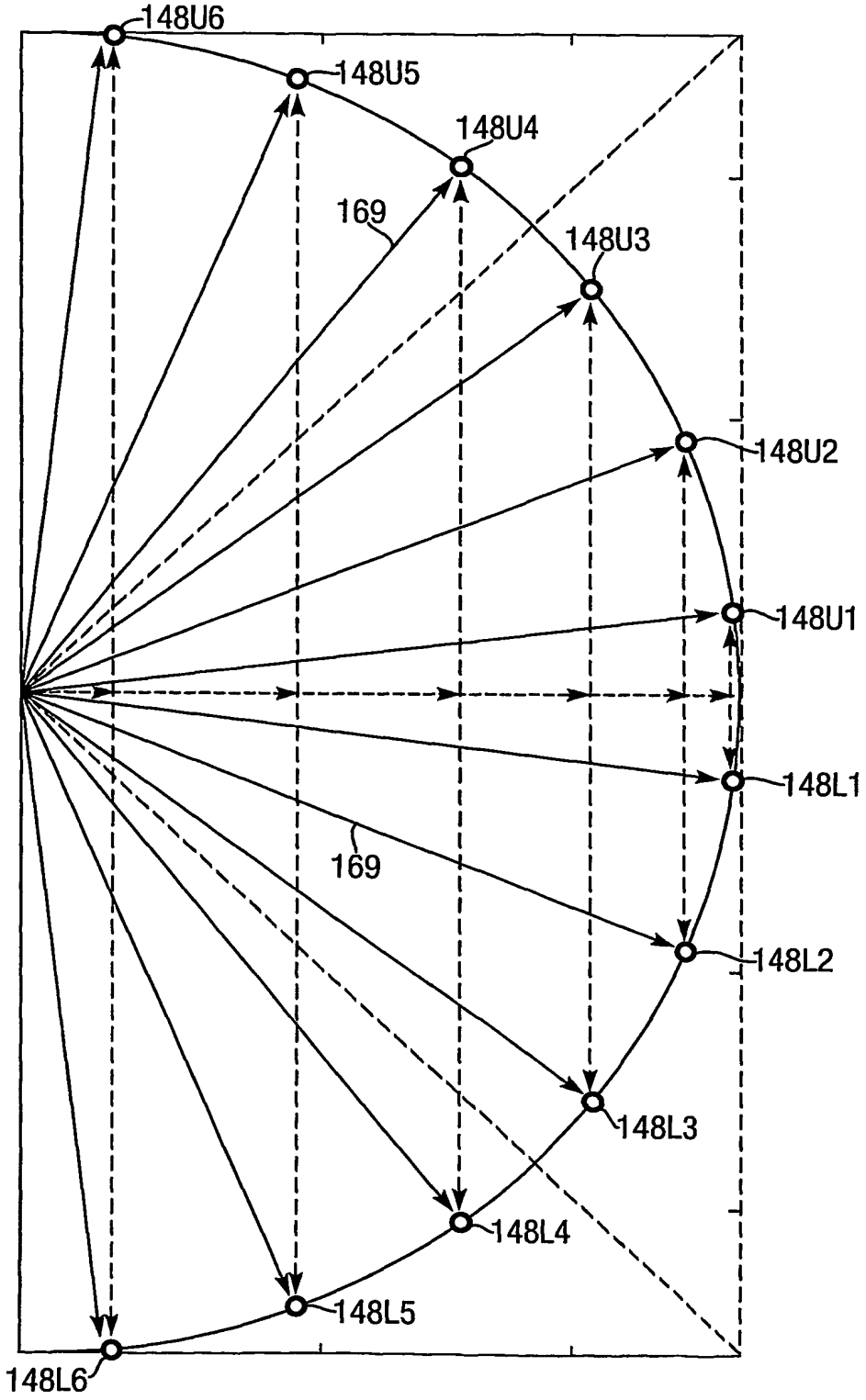

148U6
148U5
148U4
169
148U3
148U2
148U1
148L1
169
148L2
148L3
148L4
148L5
148L6

Fig.9.

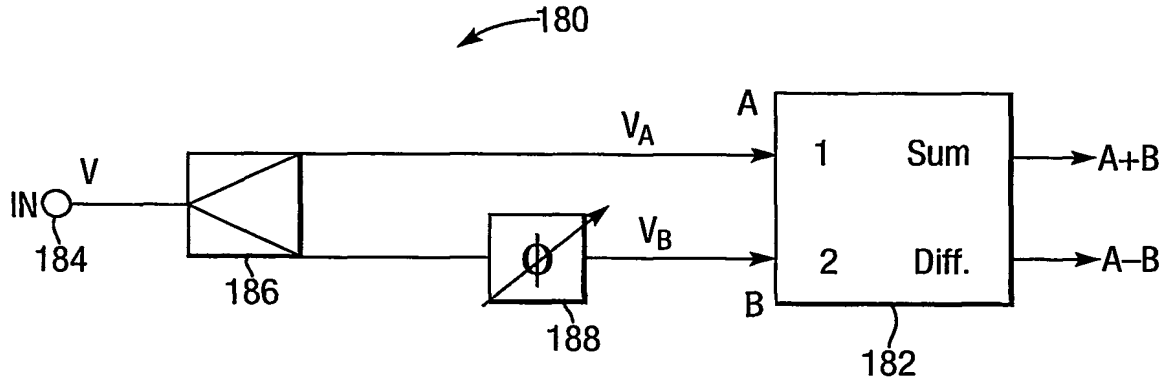

180
A
$V_A$
1
Sum
A+B
V
IN
184
186
$V_B$
2
Diff.
A–B
B
188
182

Fig.10.

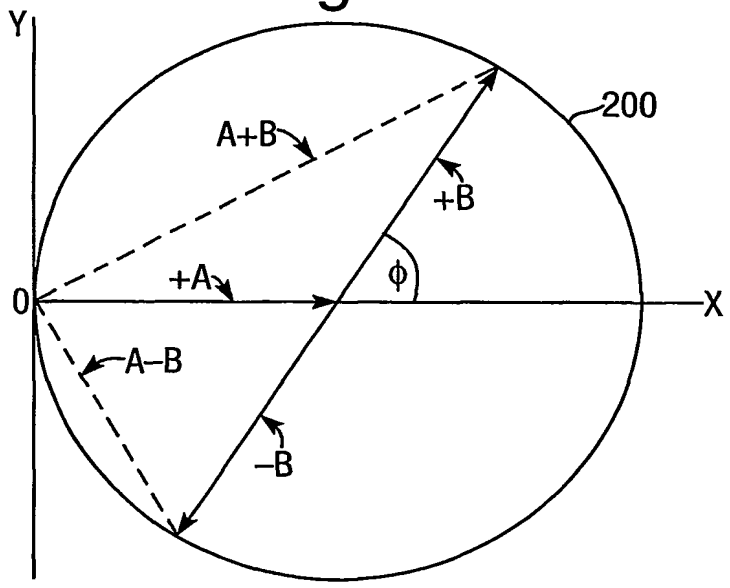

Y
200
A+B
+B
+A
ϕ
0
X
A–B
–B

Fig.11.

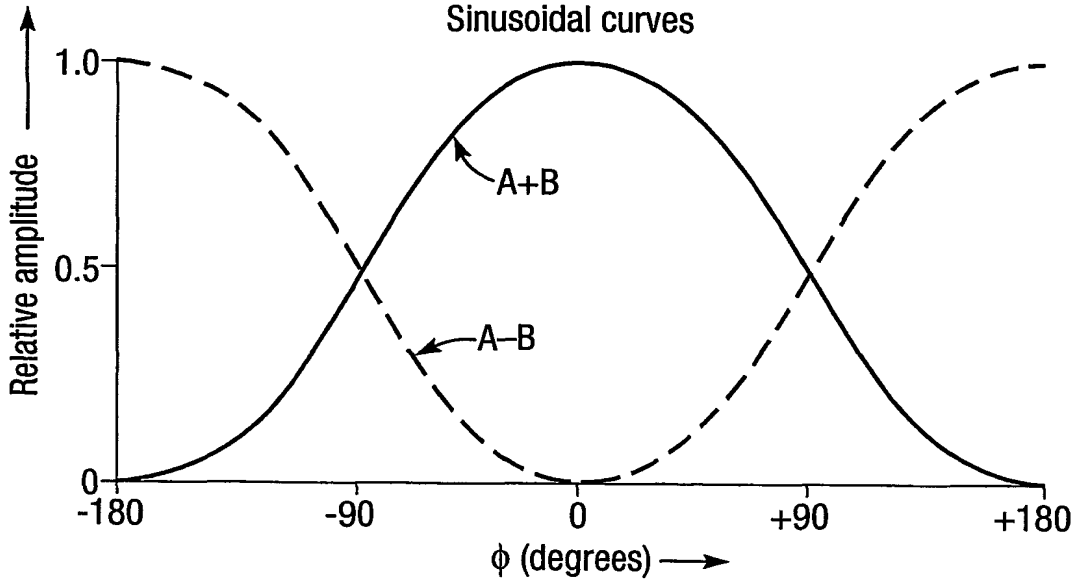
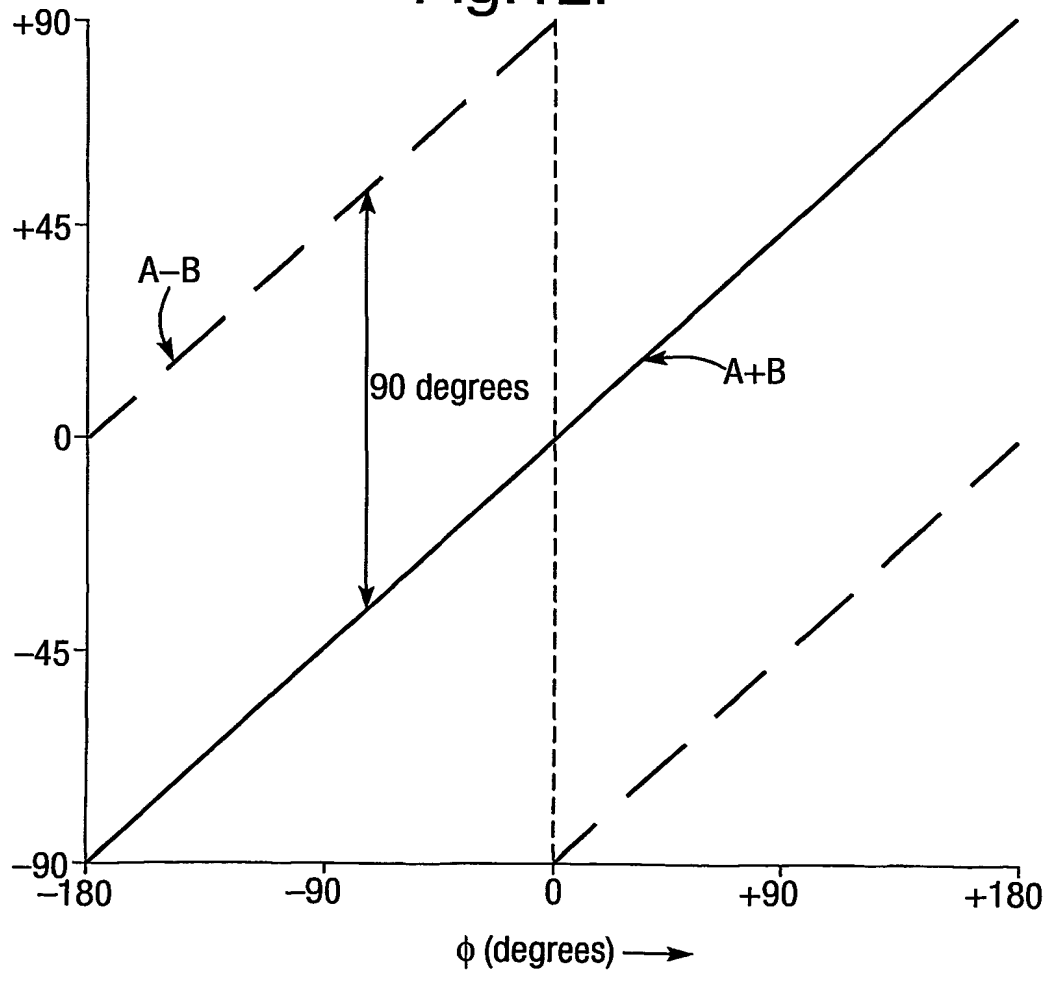

Sinusoidal curves
Relative amplitude
1.0
0.5
0
A+B
A–B
-180
-90
0
+90
+180
ϕ (degrees)

Fig.12.


+90
+45
0
–45
–90
A–B
90 degrees
A+B
–180
–90
0
+90
+180
ϕ (degrees)